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(54) DOSING DEVICE

(71) We, GERICKE AG, a Swiss body corporate, of Althardstrasse 120, CH-8105 Regensdorf, Switzerland, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a dosing device for feeding powdery or granular substances to the feed hopper of a screw conveyor machine.

Such dosing devices are known, for example, from the literature (Dr. Ing. G. Schenkel "Screw extruders for plastics", 1959 edition, page 301, Figure 315).

It is desirable to regulate the supply of plastics material to be prepared in a screw conveyor machine in such a way that the receiving capacity of the machine largely corresponds to its output, that is, the quantity of material supplied per unit of time is equal to the output.

The starting material in the form of powder or granules is stored after preparation thereof in large collecting containers for the purpose of subsequent removal and further processing in screw machines or injection moulding machines. During transport to the collecting containers and on removal from them, metal foreign bodies can easily enter the material and in further processing can cause severe damage in the precision-made housing wall and the screw of a screw extruder.

To prevent this, there have already been arranged between the discharge end of a dosing screw and the feed mechanism of a screw machine so-called metal separators which record by means of an induction field the flow of material loaded with a foreign body and briefly shunt it off via a guide mechanism. The detected foreign body together with a not inconsiderable quantity of material enters a collecting container which is installed separately from the screw machine and which has to be inspected subsequently before the material can be cleared for further processing. Aa further disadvantage of these metal separators lies in the additional space required for them.

The metal separators can therefore be used advantageously where a relatively high proportion of metal foreign bodies have to be separated. On smaller preparation equipment with lower throughputs the use of special metal separators is not economic.

The object of the invention is to provide a dosing device for screw machines which enables the prevention of the passage of metal foreign bodies in the dosing material and allows them to be separated from the dosing material by a simple operation.

According to the invention there is provided a dosing device for feeding a particulate or powdery dielectric material to the feed hopper of a screw conveyor machine and for the detection of metal objects therein, comprising a filling container having an opening for said material, a dosing screw for conveying the material through a conveying stage extending from the filling container to the feed hopper, a drive for the dosing screw, the dosing screw being formed of a dielectric material, an induction coil surrounding a part of the length of the conveying state, and a switching mechanism connected to the induction coil arranged so as to switch off the drive of the dosing screw when a metal object is detected by the induction coil.

It is thereby possible, even when the dosing device is connected directly to a substantially gas-tight feed hopper of the screw machine, to guarantee reliable inspection of the dosing material before it is fed. The dosing device allows unobstructed access to the feed hopper. Separate metal detectors and separators hitherto arranged immediately upstream of the dosing device or between the latter and the feed hopper are no longer required. This is of particular advantage in the case of smaller machine units for which the use of separate metal detectors

and separators entails relatively high costs.

The induction coil is preferably spaced from the discharge opening of the conveying stage by at least 1.5 times the pitch of the dosing screw, as alternatively, by from 0.5 to 1.5 times the diameter of the dosing screw.

In a preferred embodiment, a tubular housing of the conveying stage is made of polytetrafluoroethylene. This makes it possible, when the outstanding dielectric properties of this material are utilised, to create an electrical stray field largely unaffected by components of the device. The induction coil can be arranged accordingly without particular difficulty at a point accessible from outside so that it can be exchanged, if necessary.

The invention is described in detail below in an embodiment thereof by reference to the accompanying drawings in which:

Figure 1 is a partial longitudinal section of the overall arrangement of a screw machine with feed hopper and dosing device;

Figure 2 is a cross-section along the line II-II of the dosing device shown in Figure 1.

As shown in Figure 1, the screw machine 1 is connected for the addition of the plastics material to be prepared at its inlet 3 to a feed hopper 2 which is sealed in a gas-tight manner by a cover 4. In the cover 4 there is a closable opening 5 which allows access to the inside of the feed hopper 2. There is also provided in the cover 4 a vent pipe 6 for the unobstructed extraction of volatile gaseous constituents or for the extraction of nitrogen which can, if required, be introduced through a feed pipe 7 to scavenge the plastics material in the feed hopper 2.

The plastics material is supplied via a dosing device 8 having a conveying stage 9 having a tubular housing passing through the wall 10 of the feed hopper 2.

The dosing device 8 comprises a filling container 11 with a laterally arranged discharge opening 12. Adjoining it is the conveying stage 9 whose discharge opening 31 is located inside the feed hopper 2. In the filling container 11 and the conveying stage 9 there is arranged a dosing screw 13 which may for example be of polytetrafluoroethylene which leads continuously into the feed hopper 2 and whose screw webs 32 virtually fill the unobstructed diameter of the conveying stage. The dosing screw 13 is connected drivably to a drive motor 14 via a continuously adjustable gear 15. By changing the speed of the dosing screw 13 the flow of material fed to the feed hopper 2 per unit of time can be controlled as desired.

A mixing element 16 which is arranged rotatably in the feed hopper 2 and which is driven via a shaft 29 connected to an electric motor 17 serves to break up the filling material introduced therein. The same purpose is fulfilled by a spiral 18 which is fitted to form a ring round the dosing screw 13 and which ensures constant mixing and, consequently, homogeneous preparation of the material supplied.

The conveying stage 9, comprising a tubular housing made of a suitable plastics material such as polytetrafluoroethylene, of the dosing device 8 is connected to the filling container 11 by means of a metal flange 19. Directly adjacent this flange 19 is an induction coil 20 which surrounds the conveying stage 9 in the form of a ring and generates a high-frequency field in the operating state. The distance of the induction coil 20 from the discharge opening 31 of the conveying stage 9 is approximately $\frac{1}{2}$ to $1\frac{1}{2}$ times the diameter of the dosing screw 13. For better adaptation to the conveying stage 9 the induction coil 20 is lined on its inner face with an insulating material 21.

The drive motor 14 of the dosing screw 13 is supplied by a mains lead 22. To cut off the current and, consequently, stop the electric motor 14, a switch 23 is used with a drive 24 which is connected to a switching relay 26 via an electrical control line 25. This switching relay 26 is connected electrically to an amplifier 27 and is switched in dependence on the induction coil 20.

To feed the amplifier 27 and, consequently, the induction coil 20, as well as the switching relay 26 and the drive 24 of the switch 23, a transformer 28 connected to the mains lead 22 is used as a current source for a 24-volt voltage supply.

The following mode of operation is accordingly obtained:

The dosing material flowing through the high-frequency field of the coil 20 during a dosing operation and entering the feed hopper 2 does not affect the induction coil 20 as long as no metal foreign bodies are carried through.

When such a foreign body is carried through the high-frequency field of the induction coil 20 with the product flow, this foreign body causes a change in the high-frequency field generated by the induction coil 20. This change in the high-frequency field is recorded by the amplifier which subsequently enables the switching relay 26 to be actuated by making

contact. The supply of current to the drive motor 14 is thereby cut off by the switch 23 via the drive 24.

After the drive motor 14 is switched off, the dosing screw continues to rotate by approximately 0.5 to 2 revolutions depending on the product being conveyed and on its mass, so that the foreign body is carried out of the range of influence of the induction coil 20. The starting condition of the frequency field is thus restored, so that the drive motor can be switched on again to extract the detected foreign body.

Extraction is carried out by briefly introducing a collecting ladle 30 into the cover opening 5, the electric motor 17 for the drive of the mixing element 16 remaining switched off. The normal operating condition can be resumed afterwards.

This uncomplicated detection of foreign bodies which is carried out without any mechanically moving parts guarantees its reliability.

The quantities of material separated with this device are extremely small and can subsequently be destroyed.

WHAT WE CLAIM IS:—

1. A dosing device for feeding a particulate or powdery dielectric material to the feed hopper of a screw conveyor machine and for the detection of metal objects therein, comprising a filling container having an opening for said material, a dosing screw for conveying the material through a conveying stage extending from the filling container to the feed hopper, a drive for the dosing screw the dosing screw being formed of a dielectric material, an induction coil surrounding a part of the length of the conveying stage, and a switching mechanism connected to the induction coil arranged so as to switch off the drive of the dosing screw when a metal object is detected by the induction coil.

2. A device as claimed in claim 1, wherein the induction coil is spaced from the discharge opening of the conveying stage by at least 1.5 times the pitch of the dosing screws.

3. A device as claimed in claim 1, wherein the induction coil is spaced from the discharge opening by from 0.5 to 1.5 times the diameter of the dosing screw.

4. A device as claimed in any preceding claim, wherein a tubular housing of the conveying stage and the dosing screw are made of polytetrafluoroethylene.

5. A device as claimed in any preceding claim, wherein the drive for the the dosing screw comprises an electric motor and said switching mechanism comprises a switch for the electric motor operated by a switch drive which is connected to the induction coil via a switch relay and an amplifier.

6. A dosing device substantially as herein described with reference to the accompanying drawings.

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1591470 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

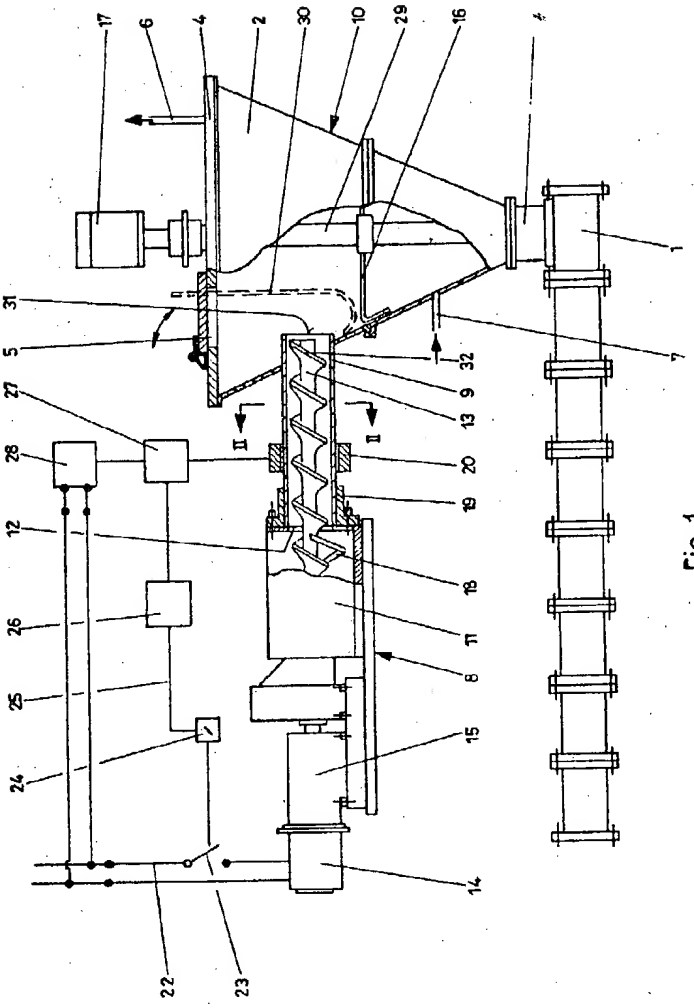

Fig. 1

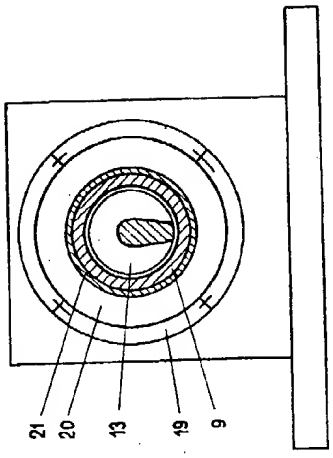

Fig.2